M e m o r a n d u m

Date: May 15, 2001

To: Tara Smith

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Subject: Simulated DOC to Historical DICU Correlations

The purpose of this analysis was to determine statistical correlations between simulated Dissolved Organic Carbon (DOC) concentrations and historical Delta Island Consumptive Use (DICU) data. Ganesh Pandey conducted a Delta Simulation Model II (DSM2) validation study for DOC documented in Chapter 3 of the Delta Modeling Group 2001 Annual Report. Simulation results for DICU covered the time period March 1991-September 1998. This time period covered a wide range of water year types (Table 1). Thus, it was determined that the simulation results provided a data set of sufficient length and variability for a first cut determination of correlation between DOC concentrations and DICU.

Table 1: Water Year Type Designations

Year	SAC 40-30-30
1991	Critical
1992	Critical
1993	Above Normal
1994	Critical
1995	Wet
1996	Wet
1997	Wet
1998	Wet

Simulation results from seven locations were correlated with historical DICU data. The seven locations are Clifton Court Forebay, Santa Fe Bacon Island, Delta Mendota Canal, Contra Costa Canal, Old River Bacon Island, Old River near DMC and Clifton Court, and Los Vaqueros Intake (Figure 1). Correlation coefficients were computed between simulated monthly average DOC concentrations and historical monthly Delta-wide consumptive use values. The correlation coefficients were computed using the CORREL function in Excel that uses the following formula:

$$\rho_{x,y} = \frac{\frac{1}{n}\sum_{n=1}^{n}(x_i - \mu_x)(y_i - \mu_y)}{\sigma_x \sigma_y}$$

where: $-1 \le \rho_{x,y} \le 1$

$\rho_{x,y}$ Correlation Coefficient between data sets x and y

n Number of values in each data set

x, y Two independent data sets (arrays) to be correlated

μ Mean

σ Standard Deviation

If the correlation coefficient, $\rho_{x,y}$, equals zero, there is no correlation between the two data sets. If the correlation coefficient equals 1, the data sets are positively correlated, and large values of one data set are associated with large values of a second data set. If the correlation coefficient equals –1, the data sets are negatively correlated. Large values of one data set are associated with small values of the second data set.

The simulated DOC and historical DICU values were determined to be negatively correlated throughout the system (Table 2). Correlation coefficients were computed for monthly average minimum and maximum simulated DOC concentrations. For the monthly average simulated DOC, the correlation coefficients at the seven locations ranged from –0.55 to –0.70 with an average value of –0.62. The negative correlation indicates that high values of DICU correspond to low concentrations of DOC (Figure 2). Similarly, lower values of DICU correspond to higher concentrations of DOC. Since the correlation coefficients are not exactly equal to negative one, the correlation indicated is a general trend but not a perfect correlation.

Polynomial regression relationships were developed for each of the seven locations (Figure 3 through Figure 9). The regression equation and R^2 values are indicated on each figure. The lack of a strong correlation between DICU and DOC concentrations is further indicated by the R^2 values which ranged from 0.3087 to 0.4991. Improved R^2 values ranging from 0.5195 to 0.6723 were obtained by computing the regressions on monthly averaged DOC and DICU values (Figure 10 through Figure 16).

Table 2: Computed Correlation Coefficients for Simulated DOC and Historical DICU

	Correlation Coefficient		
Relationship	**Avg DOC**	**Min DOC**	**Max DOC**
DOC Clifton Court to DICU	-0.61	-0.37	-0.65
DOC Sante Fe Bacon Isl to DICU	-0.64	-0.52	-0.75
DOC DMC to DICU	-0.62	-0.33	-0.64
DOC CCC to DICU	-0.55	-0.29	-0.63
DOC Old R Bacon Is to DICU	-0.70	-0.59	-0.74
DOC Old R-DMC-CL to DICU	-0.63	-0.35	-0.65
DOC Los Vaqueros to DICU	-0.61	-0.47	-0.47
Average	*-0.62*	*-0.41*	*-0.65*

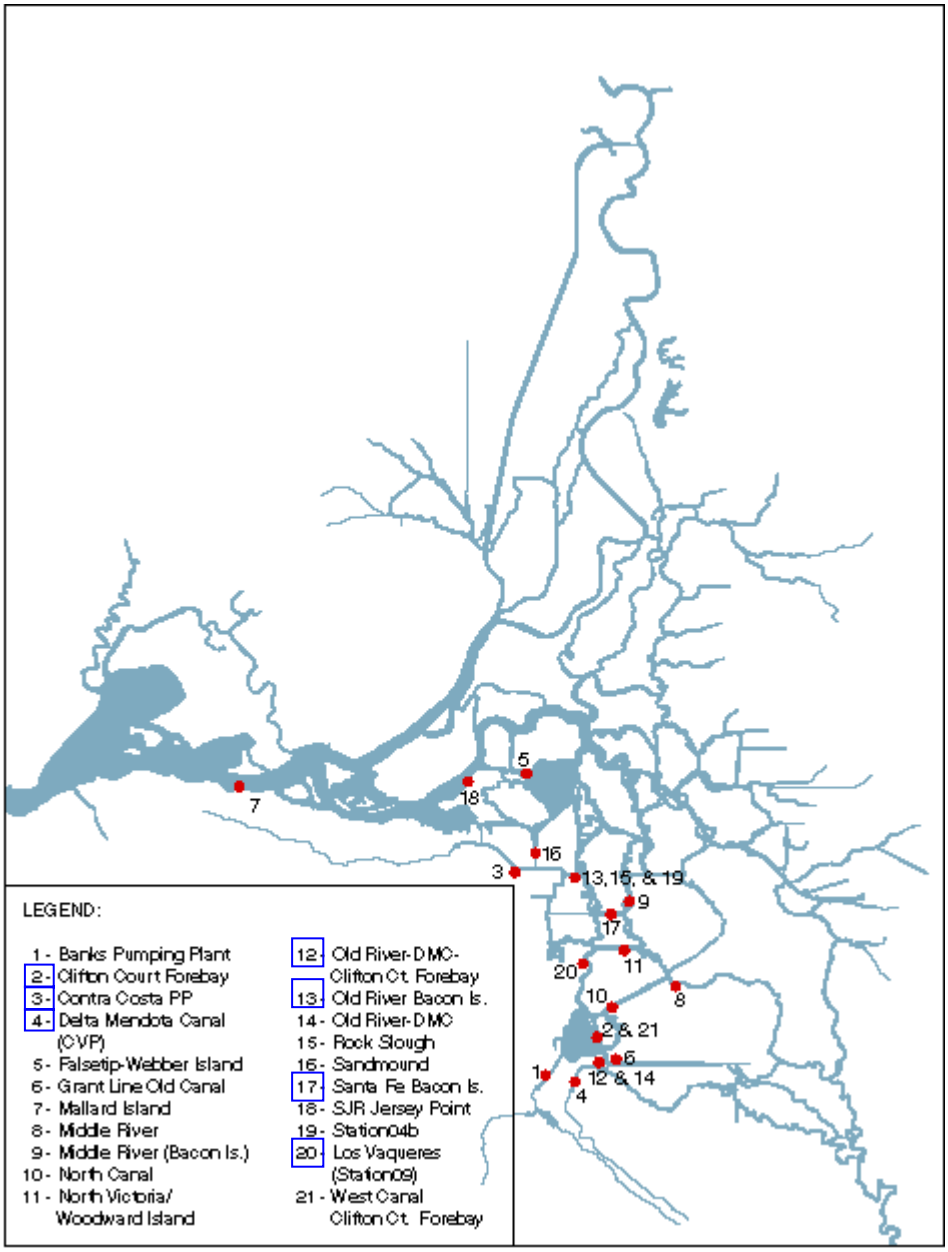


Figure 1: DSM2 Output Locations for DOC Validation Study
Location numbers highlighted in the legend indicate sites utilized in the correlation analysis

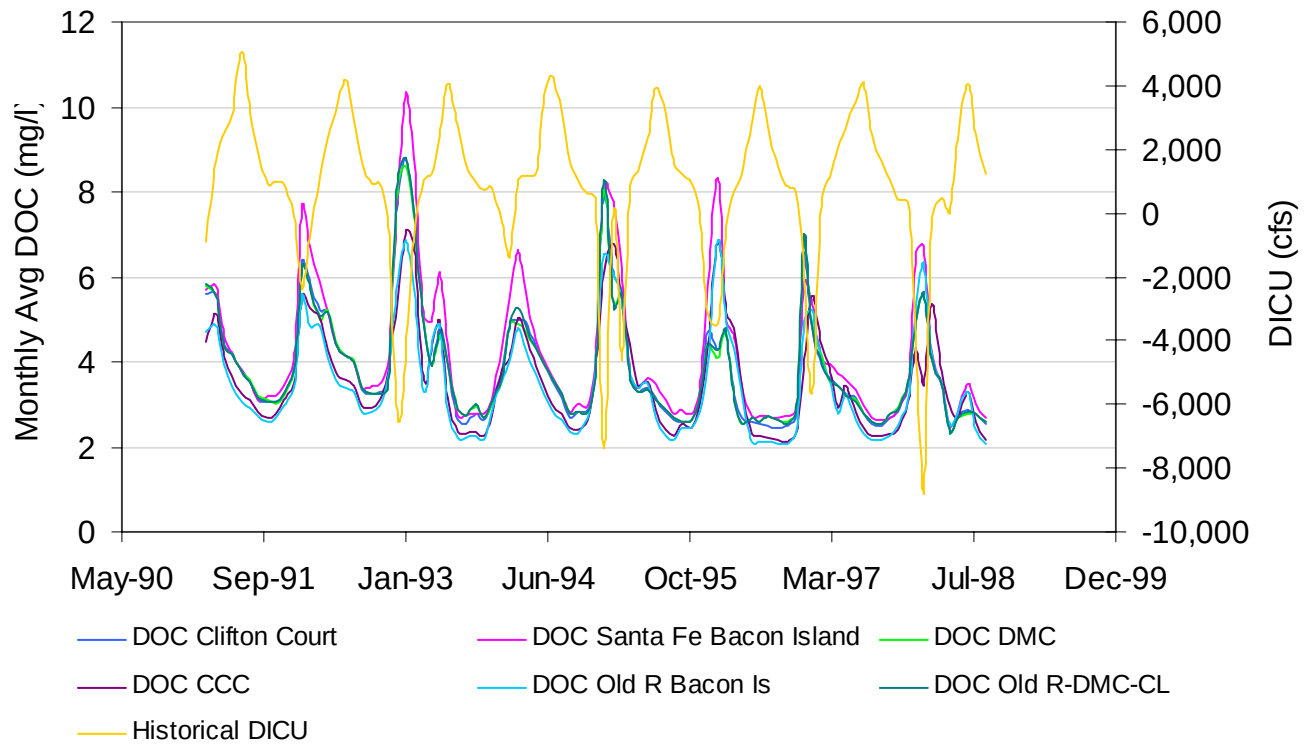


Figure 2: Simulated Monthly Average DOC Concentrations Compared to Historical DICU

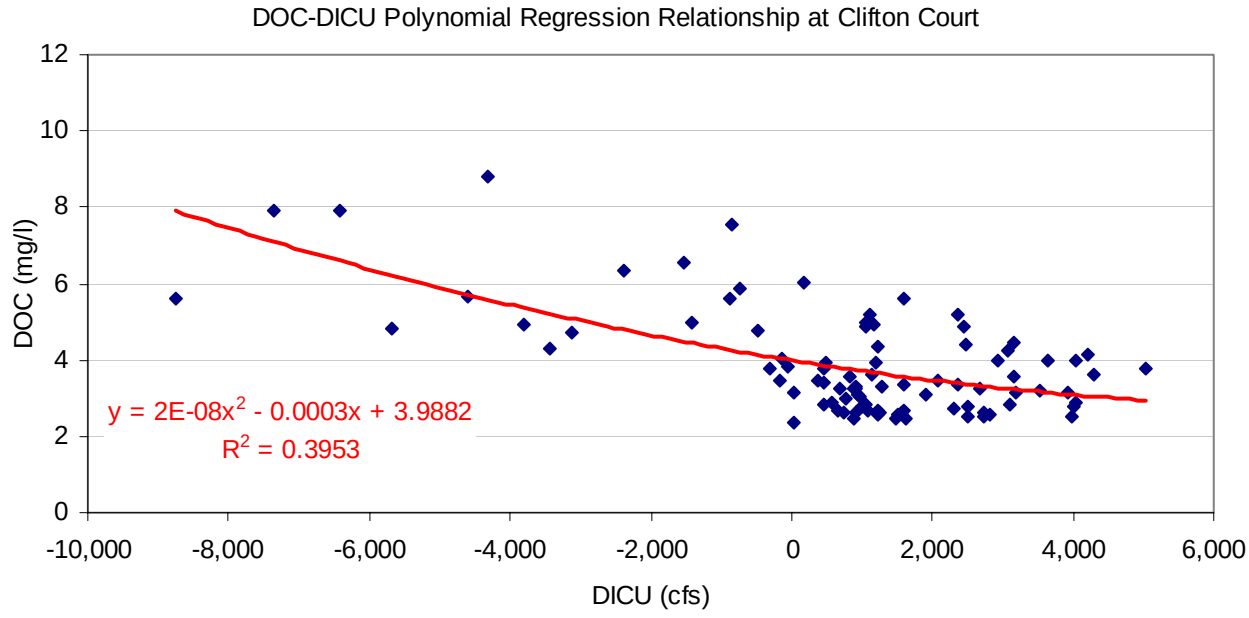


Figure 3: Polynomial Regression Relationship between DOC and DICU at Clifton Court

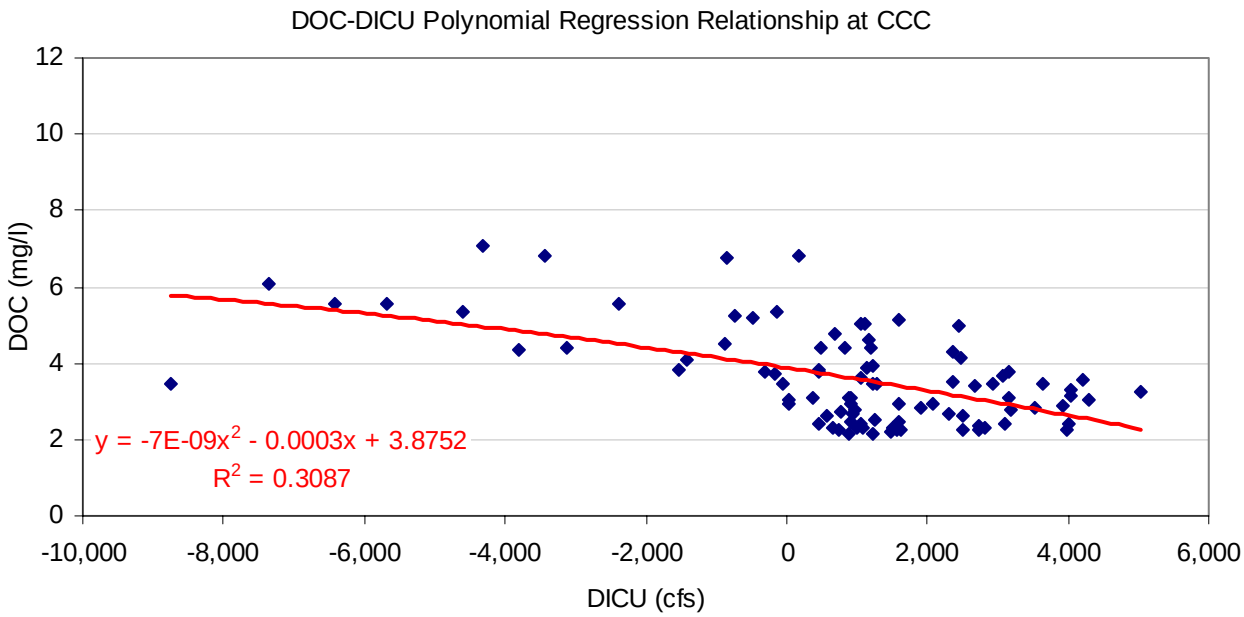


Figure 4: Polynomial Regression Relationship between DOC and DICU at Contra Costa Canal

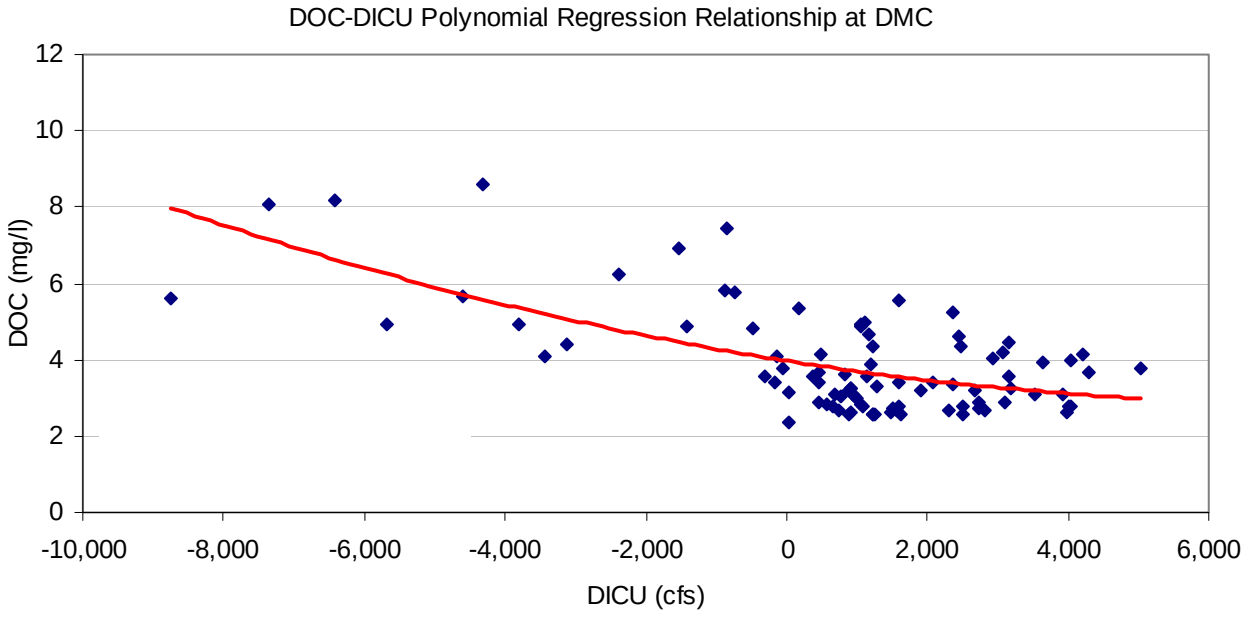


Figure 5: Polynomial Regression Relationship between DOC and DICU at Delta Mendota Canal

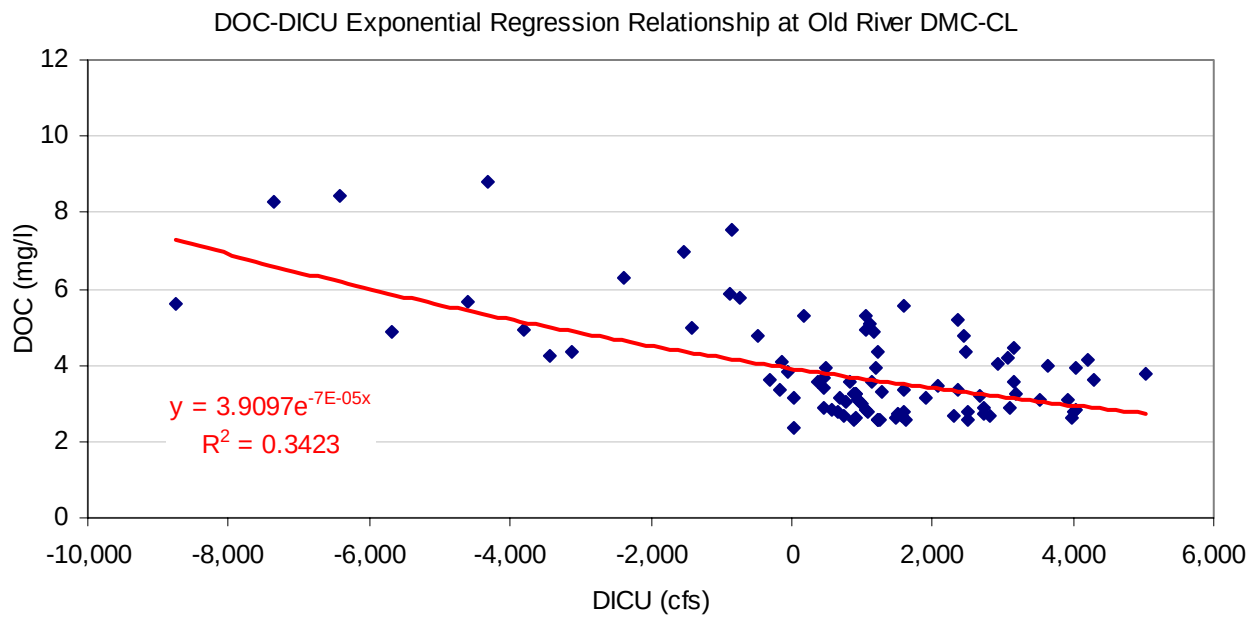


Figure 6: Polynomial Regression Relationship between DOC and DICU at Old River Delta Mendota Canal-Clifton Court Forebay

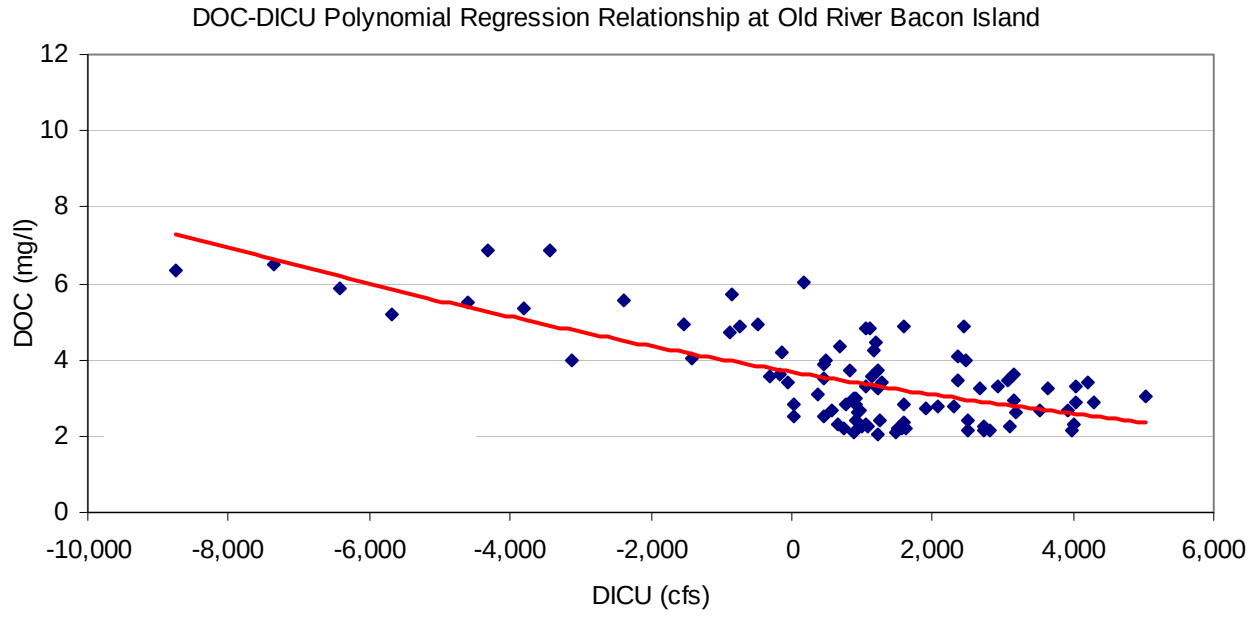


Figure 7: Polynomial Regression Relationship between DOC and DICU at Old River Bacon Island

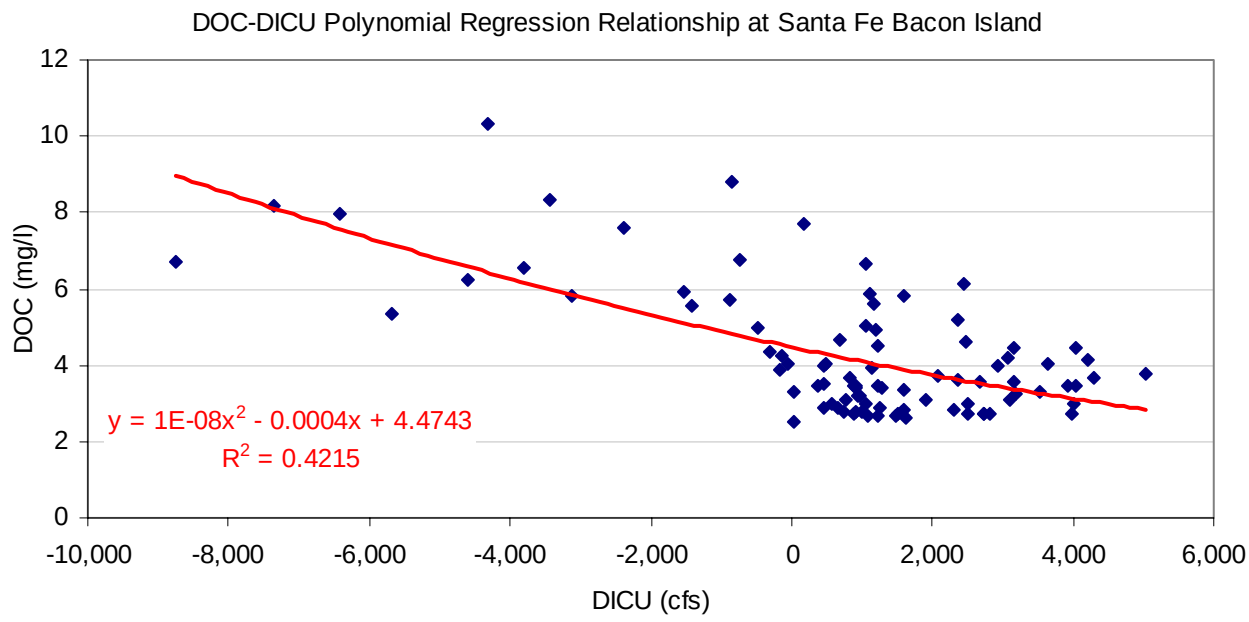


Figure 8: Polynomial Regression Relationship between DOC and DICU at Sante Fe Bacon Island

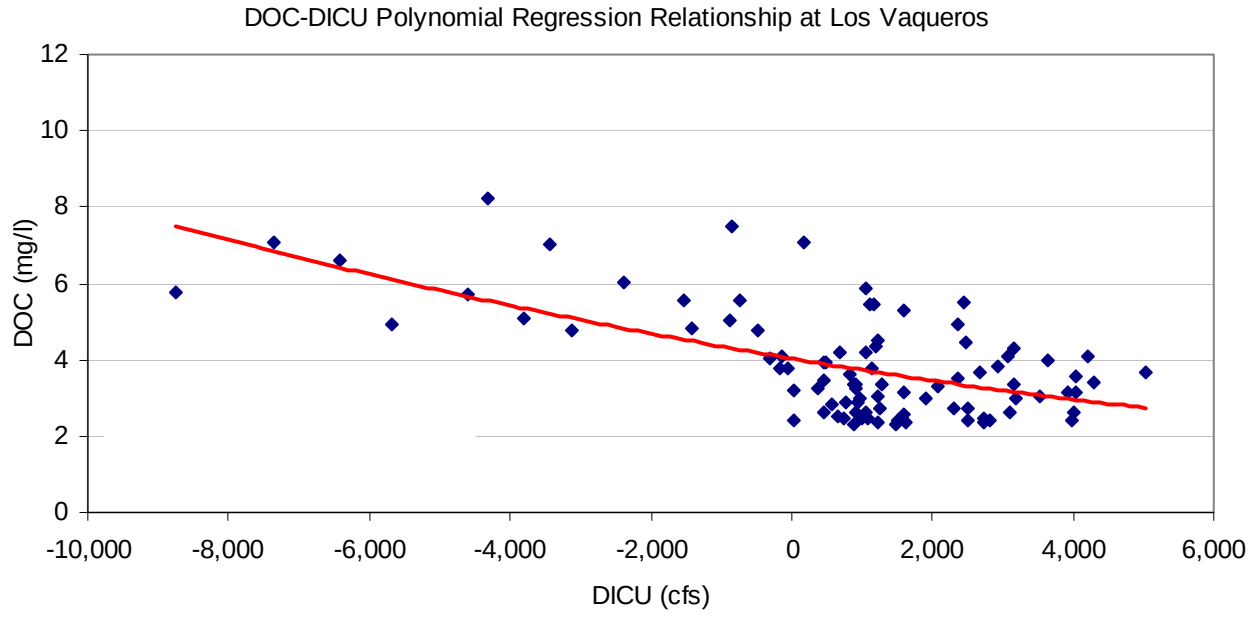
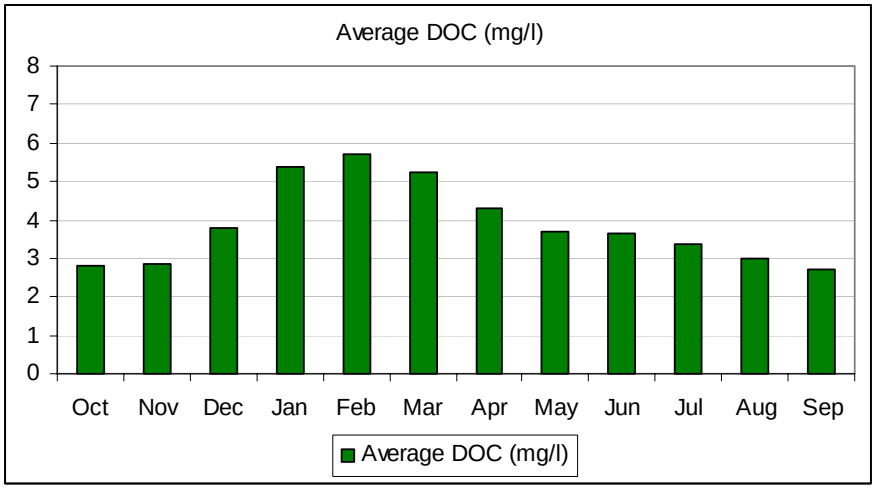
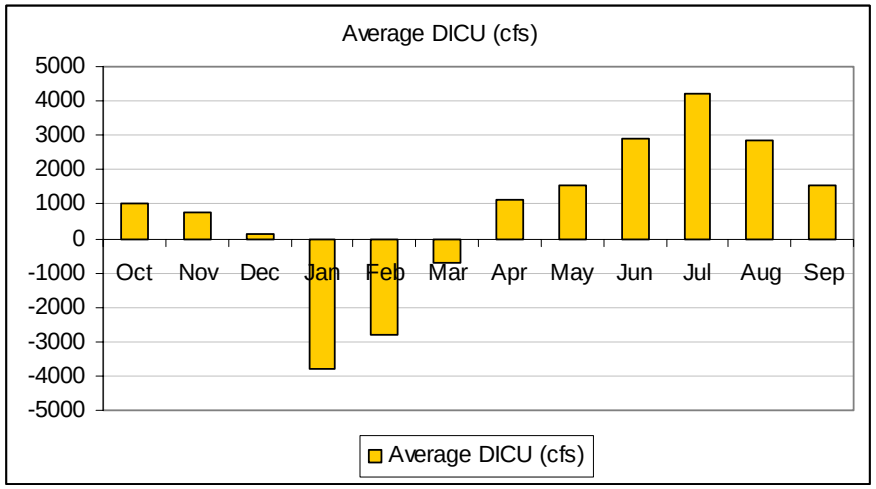


Figure 9: Polynomial Regression Relationship between DOC and DICU at Los Vaqueros





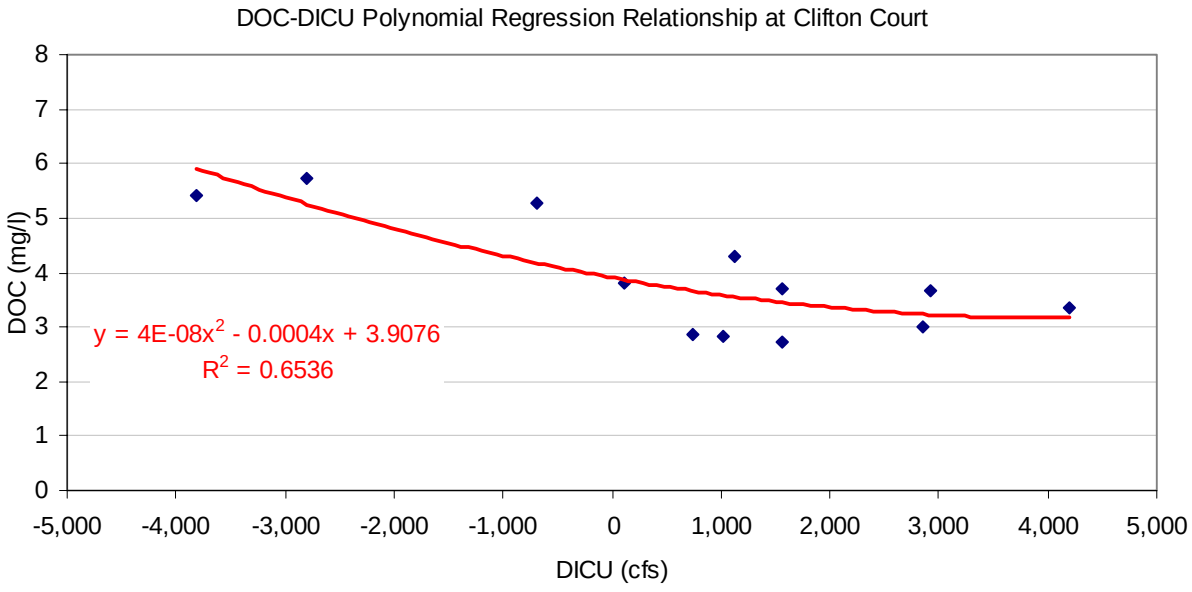
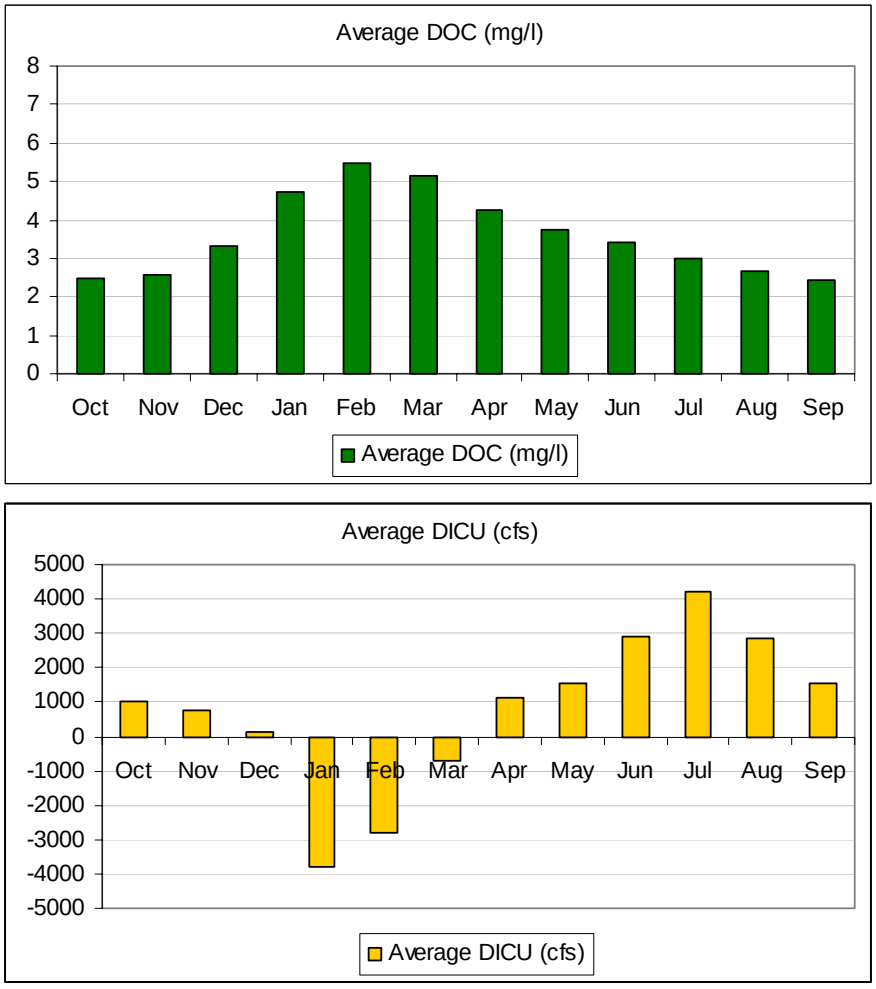


Figure 10: Polynomial Regression of Monthly Average DOC and DICU at Clifton Court



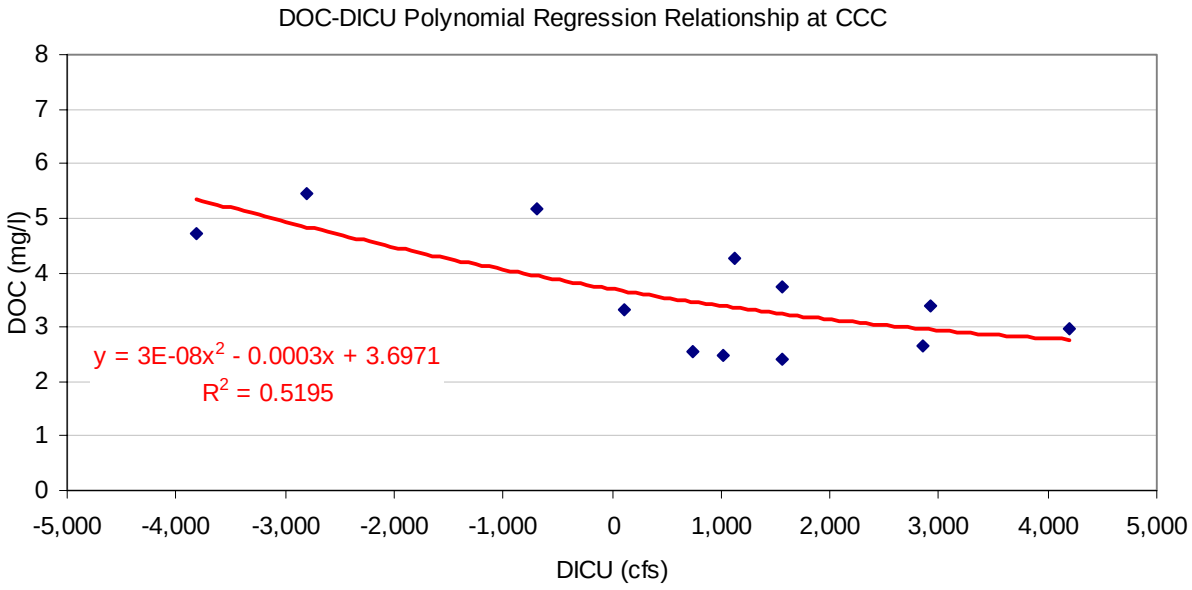
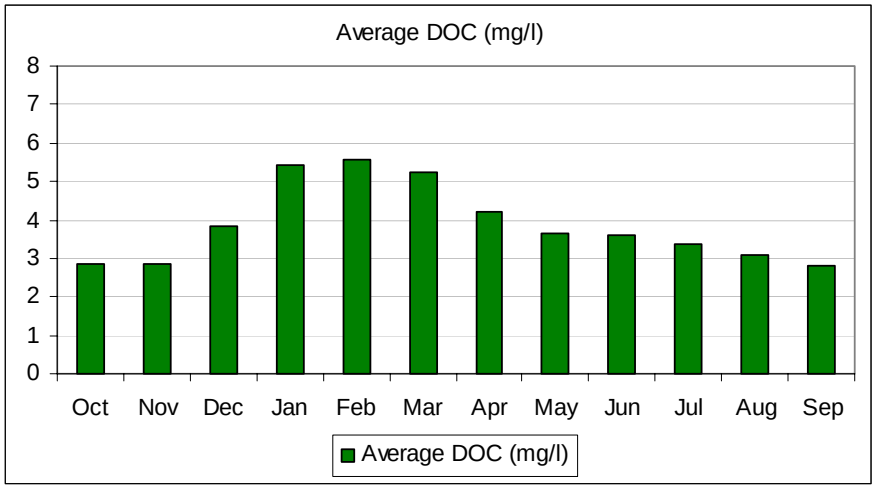
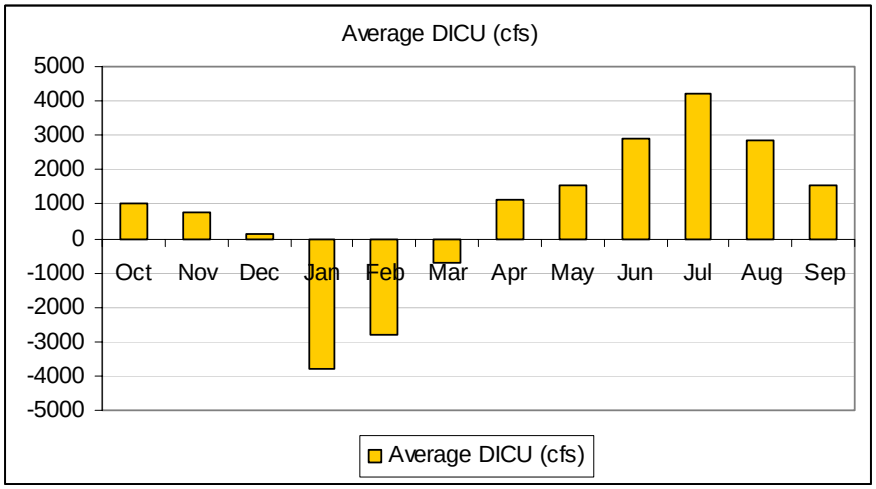


Figure 11: Polynomial Regression of Monthly Average DOC and DICU at Contra Costa Canal





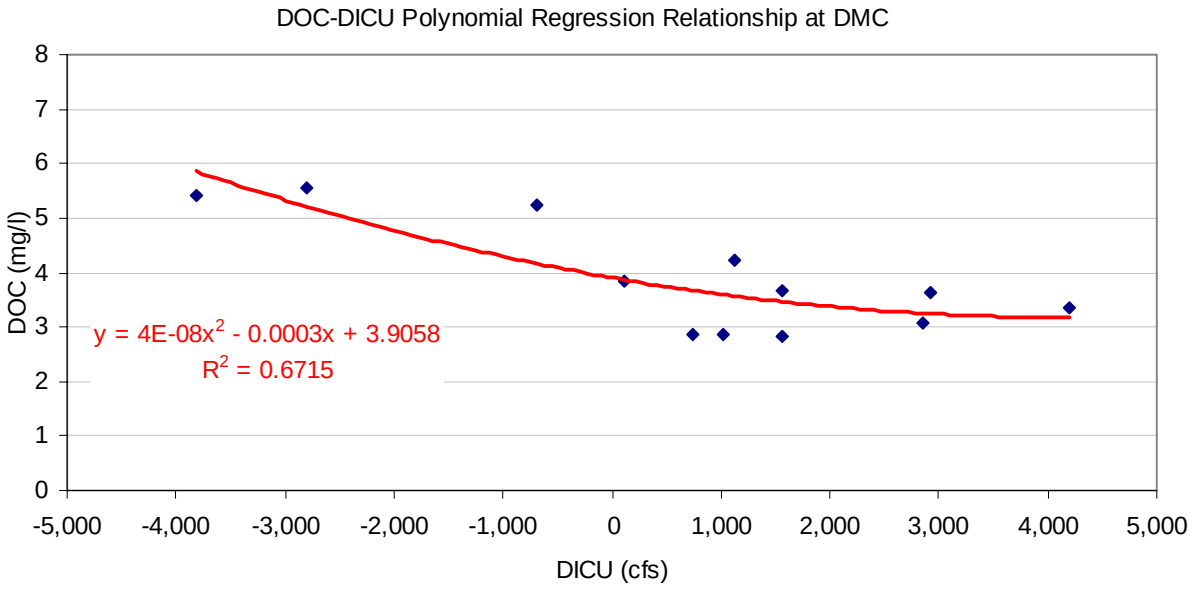
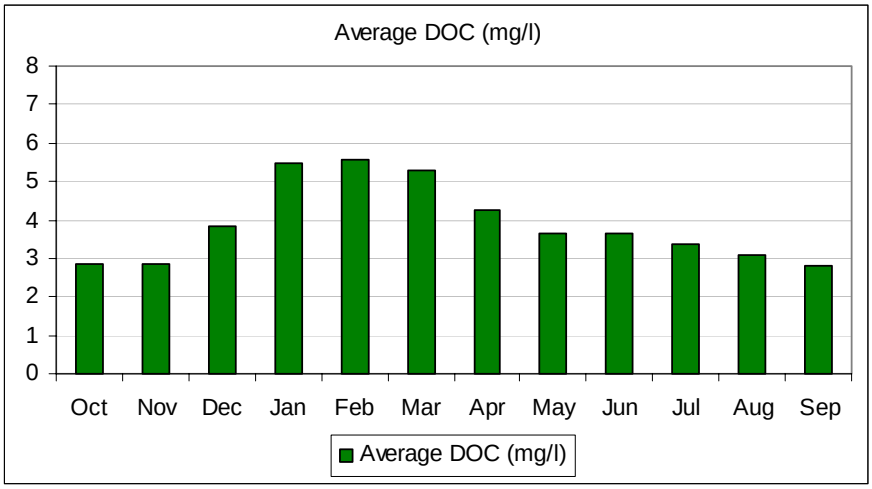
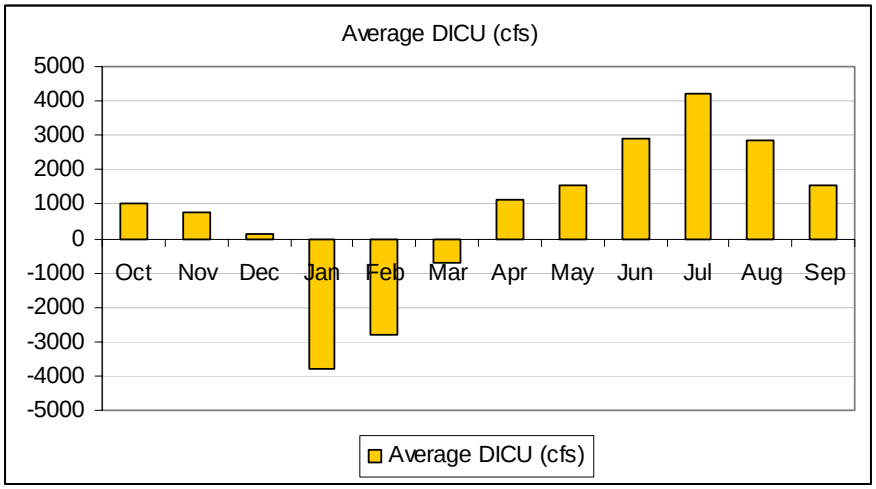


Figure 12: Polynomial Regression of Monthly Average DOC and DICU at Delta Mendota Canal





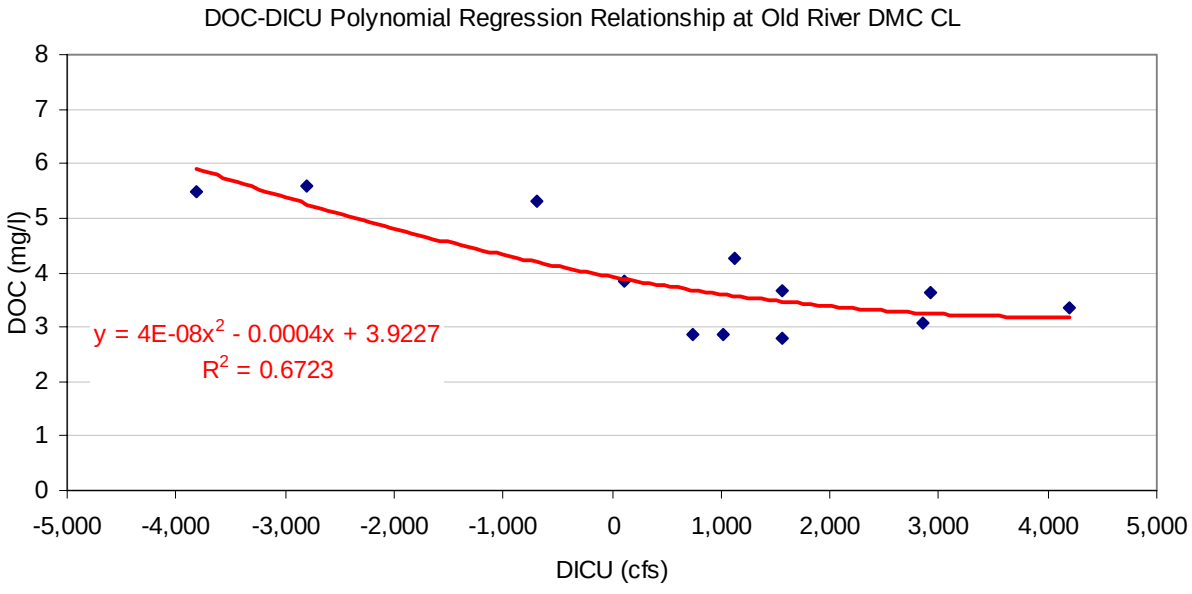
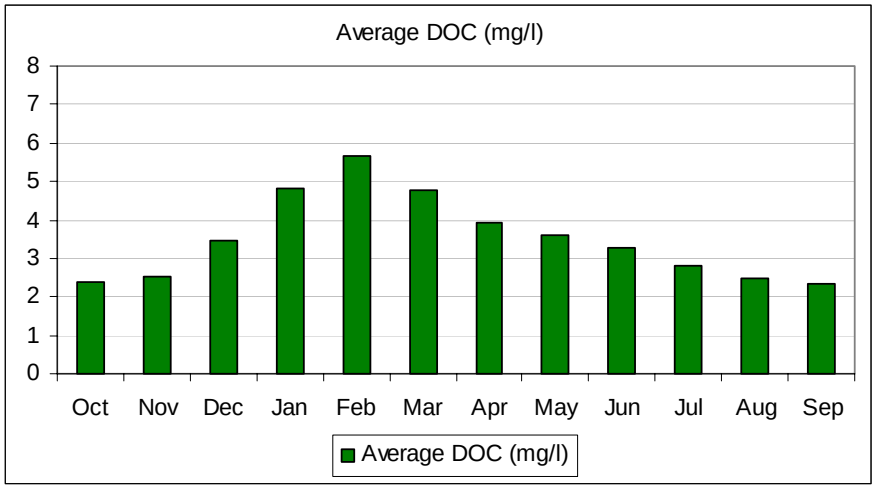
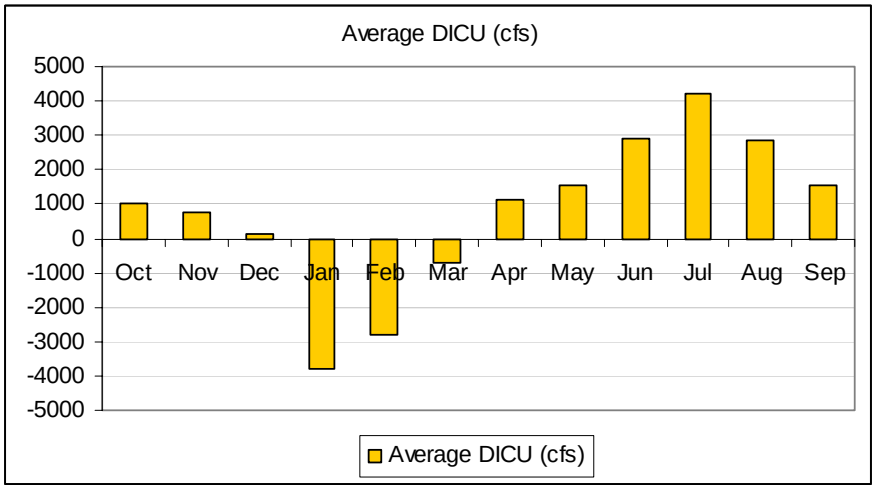


Figure 13: Polynomial Regression of Monthly Average DOC and DICU at Old River Delta Mendota Canal-Clifton Court Forebay





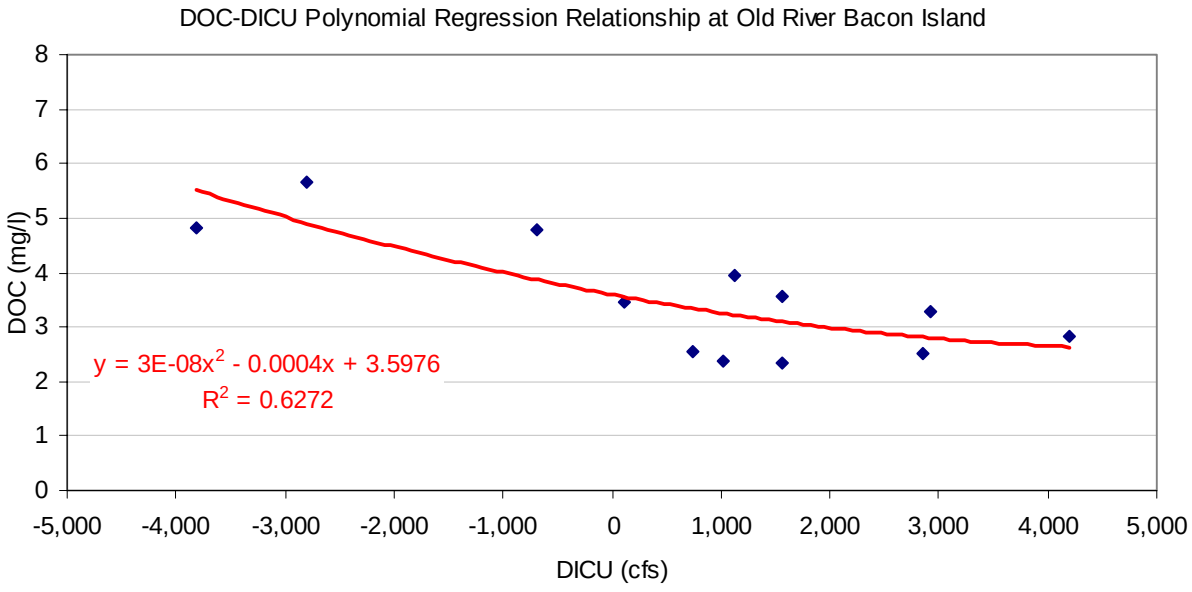


Figure 14: Polynomial Regression of Monthly Average DOC and DICU at Old River Bacon Island

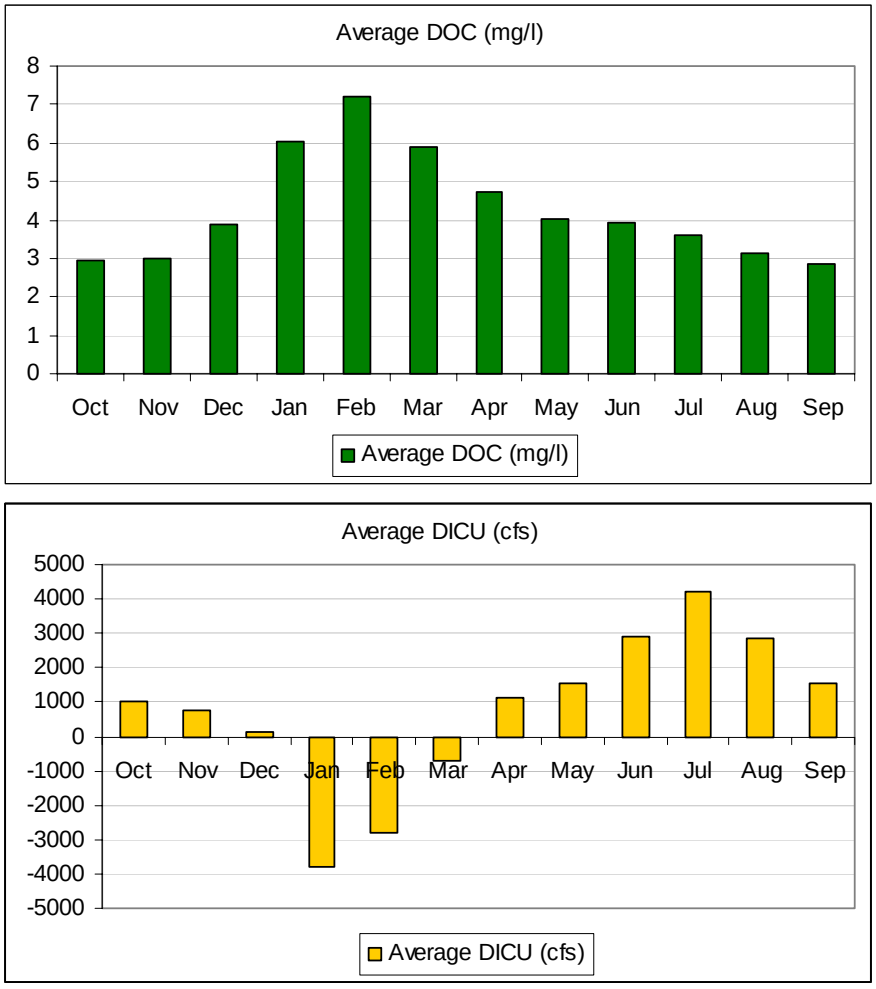
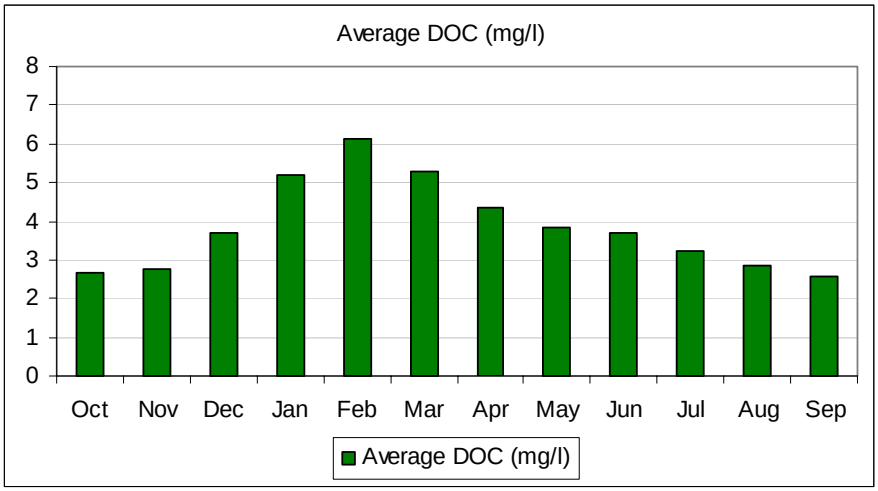
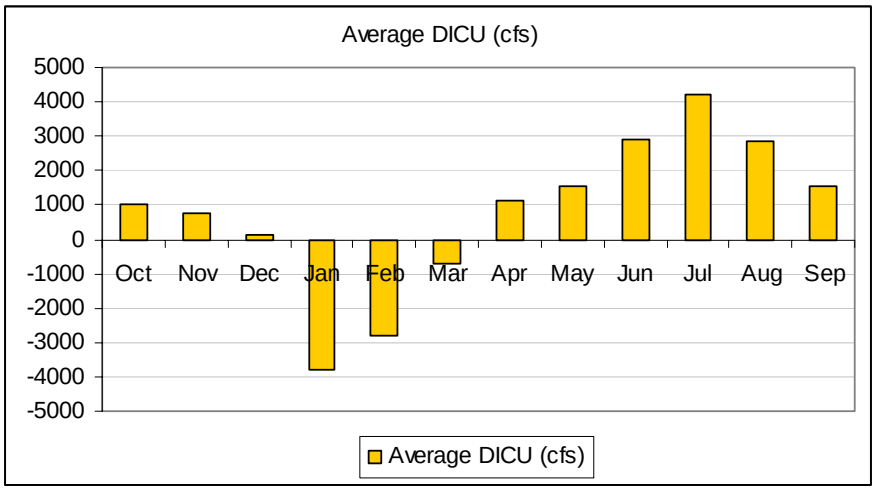


Figure 15: Polynomial Regression of Monthly Average DOC and DICU at Santa Fe Bacon Island





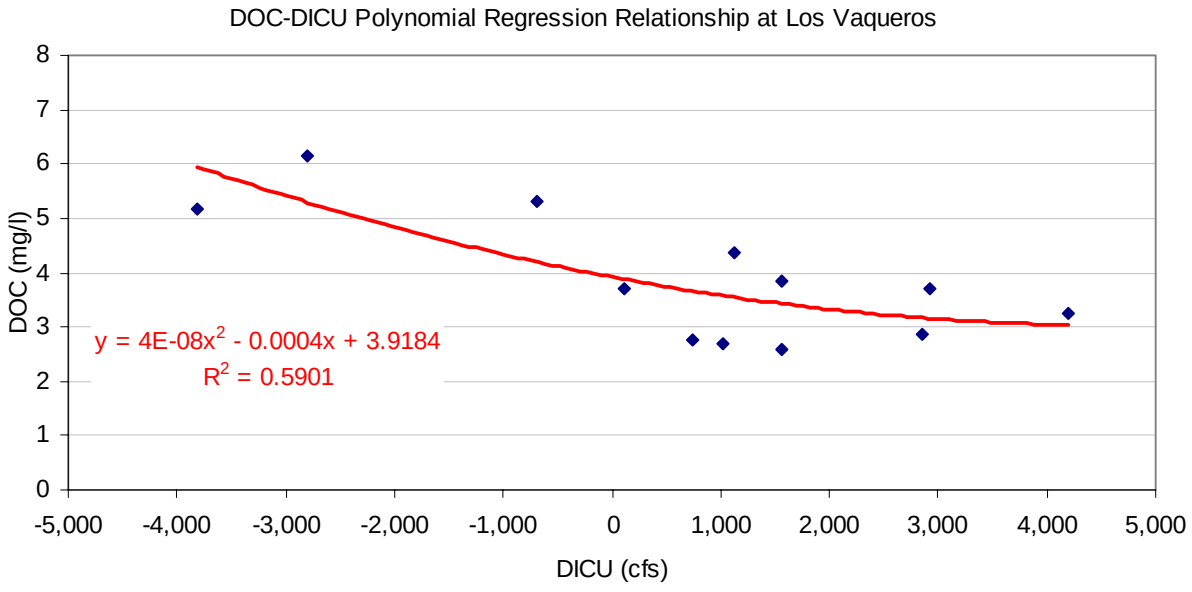


Figure 16: Polynomial Regression of Monthly Average DOC and DICU at Los Vaqueros